

## Combination Heating/Cooling Units

Note to Installer: After installation, leave these instructions, Owner's Manual and Parts Replacement Guide with equipment owner.

### INDEX

	Page
<b>SAFETY CONSIDERATIONS</b> .....	1
<b>GENERAL</b> .....	1,2
<b>INSTALLATION</b> .....	2-9
<b>Step 1 — Rig and Place Unit</b> .....	2
• ROOFTOP INSTALLATION	
• GROUND LEVEL INSTALLATION	
• CLEARANCES	
• CONDENSATE DISPOSAL	
• VENTING	
<b>Step 2 — Make Gas Piping Connections</b> ..	5
<b>Step 3 — Make Duct Connections</b> .....	6
<b>Step 4 — Make Wiring Connections</b> .....	7
• HIGH-VOLTAGE CONNECTIONS	
• SPECIAL PROCEDURES FOR 208-V OPERATION	
• LOW-VOLTAGE CONNECTIONS	
• HEAT ANTICIPATOR SETTING	
<b>START-UP</b> .....	9-18
<b>SERVICE</b> .....	18-21
<b>TROUBLESHOOTING CHARTS</b> .....	22,23

Only trained, qualified installers and service mechanics should install, start-up and service this equipment. Consult the Owner's Manual for routine maintenance. All other operations should be performed by trained service personnel.

- Follow all safety codes.
- Wear safety glasses and work gloves.
- Use care in handling, rigging and setting bulky equipment.
- Observe precautions in these instructions and on equipment tags, stickers and labels.

**WARNING:** Do not disconnect electric power to this appliance without first turning off gas supply. Be sure power to equipment is shut off before maintenance or service.

### SAFETY CONSIDERATIONS

**WARNING:** Improper installation, adjustment, alteration, service, maintenance or use can cause carbon monoxide poisoning, explosion, fire, electric shock or other occurrences which may injure you or damage your property. Consult a qualified installer, service agency or the gas supplier for information or assistance.

**NOTE:** Installation of this unit must conform to the guidelines presented in these Installation Instructions. Read and become familiar with this publication before starting installation.

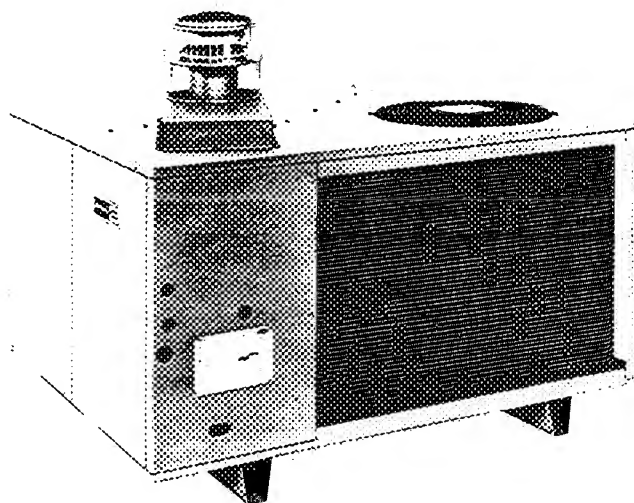


Fig. 1 — Model 48KH, KL

### GENERAL

Models 48KH, KL packaged gas/electric units (see Fig. 1) have been designed and tested in accordance with ANSI Z21.47b-1982, ARI Standard

**Table 1 — Performance Data**

MODEL 48—	NOMINAL COOLING SIZE	RATED HEATING INPUT (Btuh)	ARI* SOUND RATING
KL018300BE	018	40,000	8.0
KL024300BE	024	40,000	8.2
KH024300BE	024	60,000	8.0
KL030300BE	030	40,000	8.2
KH030300BE	030	60,000	8.2
KL036300BE	036	60,000	8.0
KL036500CE	036	60,000	8.0
KL036600CE	036	60,000	8.0
KH036300BE	036	100,000	8.0
KH036300BF	036	125,000	8.0
KH036500CE	036	100,000	8.0
KH036500CF	036	125,000	8.0
KL042300BE	042	60,000	8.2
KL042500CE	042	60,000	8.2
KH042300BE	042	80,000	8.2
KH042500CE	042	80,000	8.2
KL048300BE	048	80,000	8.4
KL048500CE	048	80,000	8.4
KL048600CE	048	80,000	8.4
KH048300BE	048	100,000	8.4
KH048300BF	048	125,000	8.4
KH048500CE	048	100,000	8.4
KH048500CF	048	125,000	8.4
KL060300BE	060	100,000	8.2
KH060300BE	060	120,000	8.2
KH060300BF	060	150,000	8.2

\*Sound rating per ARI 270-82

210-81 and ARI Standard 270-82. The units are design certified by the American Gas Association (AGA) for use with natural or LP (propane) gases with appropriate controls and orifices. See Table 1 for heating input ratings. Models 48KH, KL units are fully self-contained, combination gas-heating/electric-cooling units designed for outdoor installation on either a rooftop or ground-level slab.

These units are equipped with an energy-saving automatic, intermittent, electric spark ignition system that does not have a continuously burning pilot. All units are manufactured with natural gas controls.

Units are factory charged with R-22 refrigerant. To install: connect gas supply, air ducts, high- and low-voltage wiring and condensate drain, and install a field-supplied air filter in the return-air ductwork.

All units can be connected into existing duct systems *that are properly sized and designed to handle an airflow of 350 to 450 cfm per each 12,000 Btuh of rated cooling capacity.* See Table 7 for cooling and heating airflow requirements.

NOTE: When installing any accessory item, see Installation Instructions packaged with accessory.

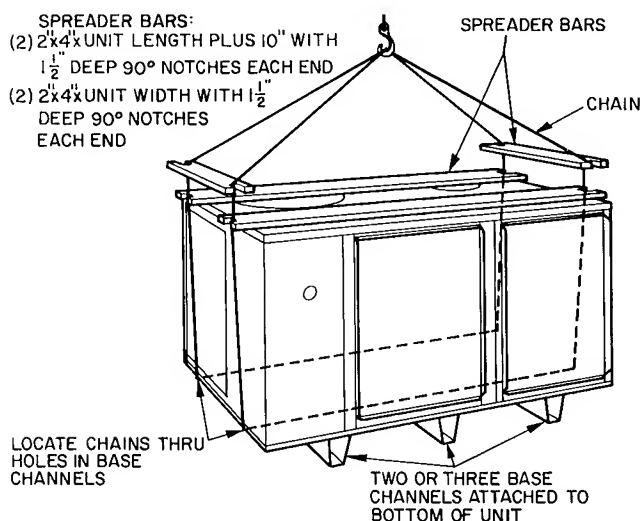
## IMPORTANT — READ BEFORE INSTALLING

1. This installation must conform with all applicable local and national codes.
2. Power supply (volts, hertz and phase) must correspond to that specified on unit rating plate.
3. Electrical supply provided by utility must be sufficient to handle load imposed by unit.
4. Refer to Fig. 4 for locations of gas inlet, electrical inlets, condensate drain, duct connections, and required clearances before setting unit in place.
5. Locate unit where vent cap will be a minimum of 4 ft from openable windows or doors.
6. Installation must conform with local building codes and with National Fuel Gas Code ANSI Z223.1-1980 or NFPA 54-1980.

## INSTALLATION

### Step 1 — Rig and Place Unit

**CAUTION:** When rigging unit to be lifted, use spreader bars to protect top and sides. Rig unit as shown in Fig. 2. Use extreme caution to prevent damage when moving unit. Unit must remain in upright position during all rigging and moving operations. Unit must be level for proper condensate drainage; therefore, the ground-level pad or accessory roof-mounting curb must be level before setting unit in place. When a field-fabricated support is used, ensure that support is level and properly supports unit and plenum.



**Fig. 2 — 48KH, KL Suggested Rigging**

## ROOFTOP INSTALLATION

**CAUTION:** When installing unit on a rooftop, be sure roof will support the additional weight. Refer to Fig. 4 to obtain total weight and corner weight information.

When installing a Model 48KH, KL end discharge unit with a field-supplied downflow plenum, a field-supplied roof-mounting curb must be installed on and flashed into roof before unit installation. When installing a Model 48KH, KL end discharge unit *without* a downflow plenum, place unit on a level base that provides proper support. On flat roofs be sure unit is located at least 4 in. above highest expected water level on roof to prevent flooding. Consult local codes for additional installation requirements.

**GROUND LEVEL INSTALLATION** — Place unit on a solid, level concrete pad that is a minimum of 4 in. thick and that extends approximately 2 in. beyond casing on all sides of unit. Do not secure unit to pad *except* when required by local codes.

**CLEARANCES** — Required minimum operating and service clearances are shown in Fig. 4 for providing adequate combustion, ventilation and condenser air.

**CAUTION:** Do not restrict condenser airflow. An air restriction at either outdoor-air inlet (the entire surface of the outdoor coil) or fan discharge can be detrimental to compressor life.

Condenser fan discharges thru top of unit. Ensure that fan discharge does not recirculate to condenser coil. Do not locate unit in either a corner or under a complete overhead obstruction. Minimum clearance under a partial overhang (such as a typical house roof overhang) is 3 ft above vent cap. Maximum horizontal extension of a partial overhang must not exceed 4 feet.

Do not locate unit where water, falling ice or snow from an overhang or roof will damage or flood the unit. Do not locate unit where grass, shrubs or other plants will interfere with the airflow either into or out of unit. Do not install unit on carpeting, tile or other combustible material other than wood flooring.

## CONDENSATE DISPOSAL

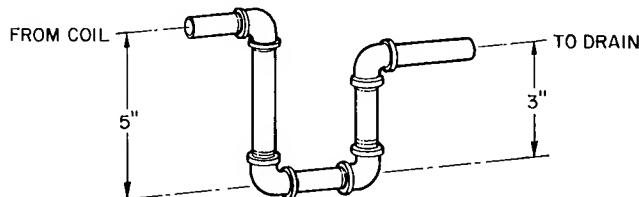
**NOTE:** Be sure condensate water disposal methods comply with local codes, restrictions and practices.

Models 48KH, KL dispose of condensate water thru a 3/4-in. MPT drain fitting. See Fig. 4 for location.

Install a 3-in. trap at the drain fitting to ensure proper drainage. See Fig. 3. Make sure trap outlet is at least 2 in. lower than unit drain pan connection to prevent pan from overflowing. Prime trap with water.

If installation requires draining the condensate water away from unit, connect a drain tube using a minimum of 7/8-in. OD copper tubing, 3/4-in. galvanized pipe or 7/8-in. plastic pipe. *Do not undersize the tube.* Pitch drain tube downward at a slope at least 1 in. for every 10 ft of horizontal run. Be sure to check drain tube for leaks.

Condensate water can be drained directly onto roof in rooftop installations (where permitted) or onto a gravel apron in ground level installations. When using a gravel apron, make sure it slopes away from the unit.



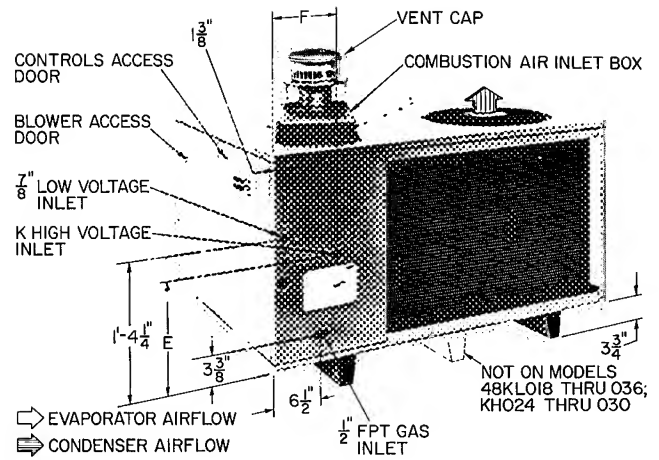
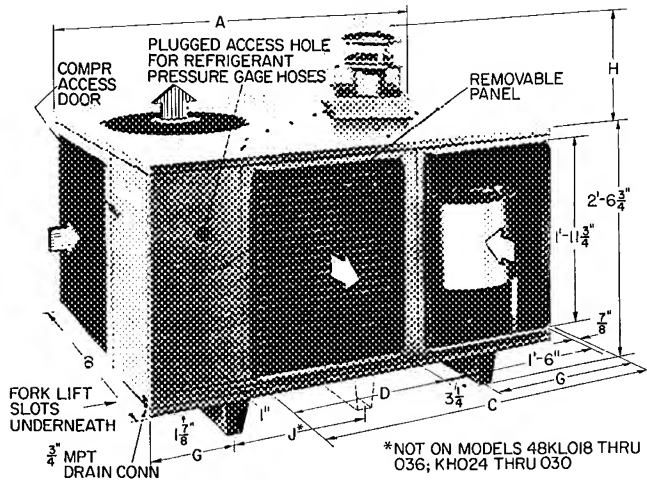
**Fig. 3 — Condensate Trap**

**VENTING** — The vent cap, combustion air shroud and flue assembly are shipped in either the blower or control compartment. Vent screen is taped to blower housing. Remove access doors to locate assemblies. See Fig. 4 for door locations.

**CAUTION:** Venting system is designed to ensure proper venting. Vent cap assembly must be installed as indicated below.

**NOTE:** Screw holes in flue assembly and unit top are positioned to ensure proper orientation when installed. Refer to Fig. 5 and install vent cap as follows:

1. Place combustion air shroud over combustion air opening in unit top, and line up screw holes in shroud with holes in top. Secure shroud to top, using screws with rubber washers (provided).
2. Place gasket and flue assembly thru hole in combustion air shroud, orient screw holes in base of flue assembly with holes in unit top, and secure gasket and flue assembly to unit top, using screws provided.
3. Form flat wire screen (provided) into circular shape around protruding lip of combustion-air shroud and bend wire ends thru holes of screen mesh to secure screen in place. Make sure that no sharp edges are left exposed.
4. Place vent cap sleeve inside flue assembly. Orient spring clip of vent cap with slot in assembly. Be sure clip snaps into slot to secure clip onto assembly.



MODEL 48-	KL018 KL024	KH024 KL030 KH030 KL036	KH036 KL042 KH042	KL048 KH048 KL060 KH060
<b>Dimensions (ft-in.)</b>				
A	4-5-5/8	4-5-5/8	5- 5-5/8	6- 0-3/8
B	2-6-3/4	3-4-3/8	3- 8-5/8	3- 8-5/8
C	3-2-1/8	3-5-1/8	3-10-1/8	4- 6-1/8
D	1-4	1-7	2-0	2-8
E	1-4	1-1-1/4	1- 1-1/4	1- 1-1/4
F	0-7-1/4	0-8-7/8	0- 8-7/8	0- 8-7/8
G	0-11	0-10	0-10	0-10-1/2
H	1-3-1/4	1-3-1/4	1- 8-1/4	1- 8-1/4
J	—	—	1-10-5/8	2- 0-11/16
K	0-1-3/32	0-1-3/8	0- 1-3/8	0- 1-3/8

#### CLEARANCES (ft-in.)

Above flue vent	3-0
Duct side of unit	0-6
Side opposite ducts	2-6
Blower access panel side	2-6
Side opposite blower access panel	2-6
Bottom of unit	0

NOTE: Provision must be made for fresh ambient air to reach the outdoor coil without recirculation of the air from the outdoor fan discharge

#### Weight Data

MODEL 48-	CORNER WT (lb)				TOTAL OPERATING WT (lb)	TOTAL SHIPPING WT (lb)
	A	B	C	D		
KL018	82	79	78	81	320	330
KL024	83	81	79	82	325	335
KH024	96	94	91	94	375	385
KL030	97	93	91	94	375	385
KH030	97	93	90	92	372	385
KL036	98	97	92	93	380	390
KH036	122	120	116	117	475	485
KL042	108	105	102	105	420	430
KH042	113	111	107	109	440	450
KL048	130	135	137	133	535	545
KH048	134	139	144	138	555	565
KL060	148	144	139	144	575	585
KH060	155	151	148	151	605	615

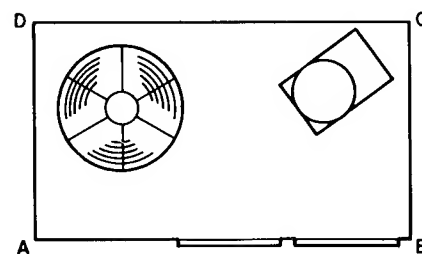
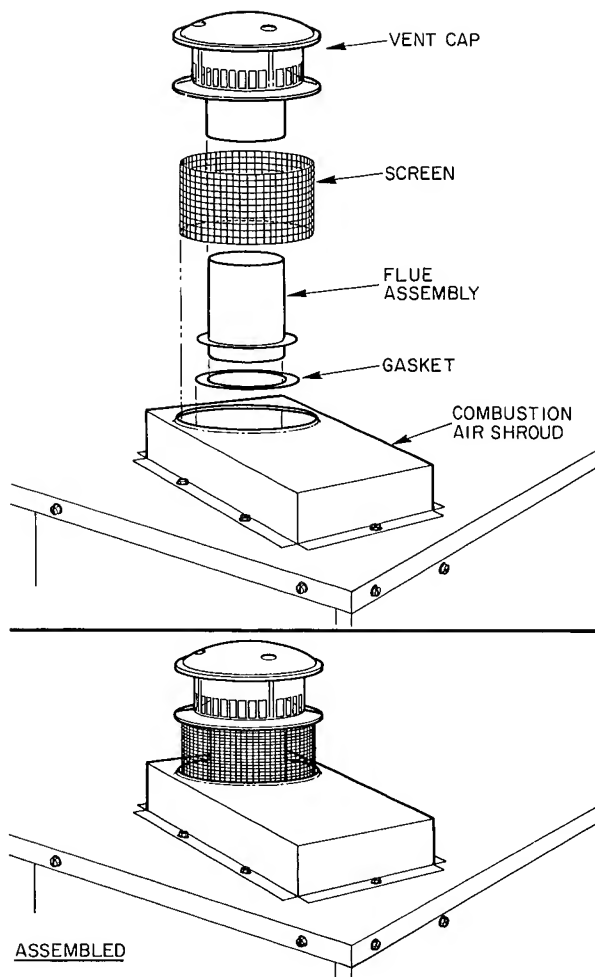


Fig. 4 — Dimensions and Clearances (ft-in.)



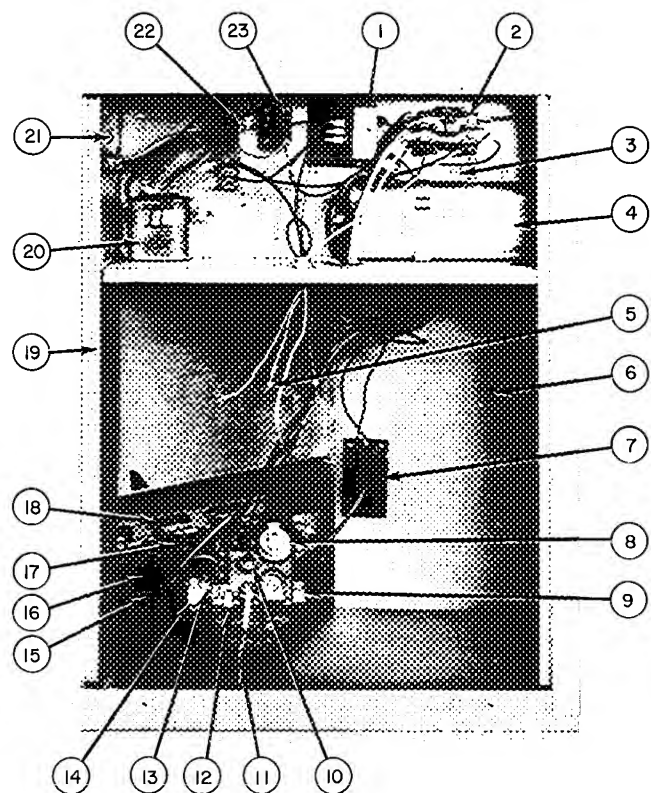
**Fig. 5 — Vent Cap Assembly**

**Step 2 — Make Gas Piping Connections** — The gas supply pipe enters unit thru access hole provided. See Fig. 4 for location. The gas connection to unit is made to the 1/2-in. FPT gas inlet on gas valve. See Fig. 6 for inlet location.

Install a separate gas supply line that runs directly from meter to heating section. *Do not use cast-iron pipe.* Check local utility for recommendations concerning existing lines. Choose a supply pipe that is large enough to keep pressure loss as low as practical. Never use pipe smaller than the 1/2-in. FPT gas inlet on gas valve.

When installing gas supply line, observe local codes pertaining to gas pipe installations. Refer to National Fuel Gas Code ANSI Z223.1-1980 or NFPA 54-1980 in absence of local building codes. Adhere to following pertinent recommendations:

1. Avoid low spots in long runs of pipe. Grade all pipe 1/4 in. in every 15 ft to prevent traps. Grade all horizontal runs downward to risers. Use risers to connect to heating section and to meter.
2. Support all piping with appropriate hangers, etc. Use a minimum of one hanger in every 6 feet. For pipe sizes larger than 1/2 in., follow recommendations of national codes.

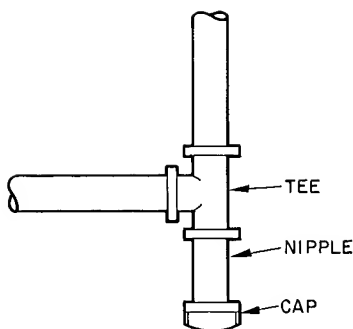


- |   |   |
|---|---|
| 1 — Control Transformer   | 11 — Pilot Tube                               |
| 2 — Compressor Contactor  | 12 — Model 646A-X Gas Valve                   |
| 3 — Ground Lug  | 13 — Pressure Tap Pipe Plug                   |
| 4 — Dual Run Capacitor (for compressor and condenser fan motor) | 14 — Gas Valve Outlet                         |
| 5 — Low-Voltage Pigtail Leads                                   | 15 — Gas Manifold                             |
| 6 — Compressor/Control Compartment Divider Panel                | 16 — Gas Burner                               |
| 7 — Igniter Module  | 17 — Burner Air Shutter                       |
| 8 — Manual ON/OFF Knob  | 18 — Secondary-Air Shield                     |
| 9 — Gas Valve Inlet   | 19 — Blower Housing                           |
| 10 — Pipe Plug — LP (Propane) unit pressure switch mounts here  | 20 — Evaporator Motor Run Capacitor           |
|   | 21 — Blower/Control Compartment Divider Panel |
|   | 22 — Heating Relay                            |
|   | 23 — Cooling Relay                            |

**Fig. 6 — Model 48KL036 — Side View (Partial) with Access Door Removed**

3. Apply joint compound (pipe dope) sparingly and only to male threads of joint when making pipe connections. Use only pipe dope that is resistant to action of liquefied petroleum gases as specified by local and/or national codes. *Never use pipe thread tape.*
4. Install a sediment trap in riser leading to the heating section. See Fig. 7. This drip leg functions as a trap for dirt and condensate. Install trap where condensate cannot freeze. Install this sediment trap by connecting a piping tee to riser leading to heating section, so that straight-thru section of tee is vertical. Then, connect capped nipple into lower end of tee. Extend capped nipple below level of gas controls.





**Fig. 7 — Sediment Trap**

5. Install an accessible, external, manual shutoff valve in gas supply pipe within 6 ft of heating section. Install a 1/8-in. NPT plugged tapping that is accessible for test-gage connection immediately upstream from gas supply connection to heating section and downstream from main manual shutoff valve.
6. Install ground-joint union close to heating section between gas valve and external manual main shutoff valve.
7. Pressure-test all gas piping in accordance with local and national plumbing and gas codes before connecting piping to unit.

**NOTE:** When pressure-testing the gas supply system *after* the gas supply piping has been connected to the unit gas valve, the supply piping must be disconnected from the gas valve during any pressure testing of the piping systems at test pressure in excess of 0.5 in. wg. When pressure testing the gas supply piping system at test pressures equal to or less than 0.5 in. wg, the unit heating section must be isolated from the gas piping system by closing the external main manual shutoff valve and slightly opening ground-joint union.

**CAUTION:** Unstable operation may occur, particularly under high-wind conditions, when gas valve and manifold assembly are forced out of position while connecting improperly routed, rigid gas piping to gas valve. Use a backup wrench when making connection to avoid strain on, or distortion of, gas control piping.

8. Where permitted by local codes, use an approved corrugated metal tubing gas connector between rigid gas piping and gas valve.

**WARNING:** Never use a match or other open flame when checking for leaks.

9. Check for gas leaks at all field-installed and factory-installed gas lines after all piping connections have been completed. Use soap-and-water solution (or method specified by local codes and/or regulations).

**Step 3 — Make Duct Connections —** Model 48KH, KL has duct flanges on the supply- and return-air openings on side of unit. See Fig. 4.

**WARNING:** The design and installation of duct system must be in accordance with standards of National Fire Protection Association for installation of non-residence type air conditioning and ventilating systems, NFPA No. 98, or residence-type NFPA No. 90B, and/or local codes and ordinances.

Adhere to the following requirements when selecting, sizing and installing duct system:

1. Select and size ductwork, supply-air registers and return-air grilles according to ASHRAE recommendations and as presented in Carrier System Design Manual, Part 2. System airflow must be within range of temperature rise and external static pressure shown on unit AGA rating plate.

**CAUTION:** When duct-system fastening holes are drilled into side of Model 48KH, KL instead of the unit duct flanges, use extreme care to avoid puncturing coil or coil tubes.

2. Use a flexible transition between rigid ductwork and unit to prevent transmission of vibration. The transition may be screwed or bolted to duct flanges. Use suitable gaskets to ensure a weather-tight and airtight seal.

**Table 2 — Filter Sizes (Field Supplied),  
Size Sq In.\***

MODEL 48—	STANDARD DISPOSABLE TYPE	CLEANABLE OR HIGH CAPACITY TYPE
KL018300BE	300	187
KL024300BE	400	257
KH024300BE	400	260
KL030300BE	522	339
KH030300BE	522	339
KL036300BE	576	374
KL036500CE	576	374
KL036600CE	576	374
KH036300BE	583	379
KH036300BF	722	451
KH036500CE	576	374
KH036500CF	694	451
KL042300BE	672	437
KL042500CE	672	437
KH042300BE	672	437
KH042500CE	672	437
KL048300BE	768	499
KL048500CE	768	499
KL048600CE	768	499
KH048300BE/BF	768	499
KH048500CE/CF	768	499
KL060300BE	950	618
KH060300BE/BF	950	618

\*Recommended air filter areas shown are based on either the ARI-rated cooling airflow or the heating airflow at a velocity of 300 fpm depending on whichever value is larger. Air filter pressure drop should not exceed 0.08 in. wg for unit to produce the rated cooling performance.

3. Install external, field-supplied air filter(s) in return-air ductwork where it is easily accessible for service. Recommended filter sizes are shown in Table 2.
4. Size all ductwork for maximum required airflow (either heating or cooling) for unit being installed. Avoid abrupt duct size increases or decreases.
5. Adequately insulate and weatherproof all ductwork located outdoors. Insulate ducts passing thru an unconditioned space, and use a vapor barrier in accordance with the latest issue of SMACNA and NESCA minimum installation standards for heating and air conditioning systems. Secure all ducts to building structure.
6. Flash, weatherproof and vibration-isolate all openings in building structure in accordance with local codes and good building practices.

#### Step 4 — Make Wiring Connections

**WARNING:** Unit cabinet must have an uninterrupted, unbroken electrical ground to minimize the possibility of personal injury if an electrical fault should occur. This ground may consist of electrical wire connected to unit ground lug in control compartment, or conduit approved for electrical ground when installed in accordance with National Electrical Code ANSI/NFPA 70-1981 and local electrical codes. *Do not use gas piping as an electrical ground.* Failure to follow this warning could result in the installer being liable for personal injury of others.

**CAUTION:** Failure to follow these precautions could result in damage to unit being installed.

1. Make all electrical connections in accordance with National Electrical Code ANSI/NFPA 70-1981 and local electrical codes governing such wiring.
2. Use only *copper* conductor for connections between the field-supplied electrical disconnect switch and the unit. *Do not use aluminum or copper-clad aluminum wire.*
3. Ensure that high-voltage power to unit is within operating voltage range indicated on unit rating plate. On 3-phase units, ensure that phases are balanced within 2%. Consult local power company for correction of improper voltage and/or phase balance.
4. When low-voltage control wires are run in same conduit as high-voltage wires, insulate low-voltage wires for highest voltage contained within conduit.
5. Do not damage internal components when drilling thru any panel to mount electrical hardware, conduit, etc.
6. Make sure service conductors used between electrical service panel and field-supplied electrical

disconnect switch do not have a current capacity less than the copper wire specified, and do not create a total voltage drop in excess of 2% of rated voltage of the unit when compressor is operating.

**NOTE:** When using aluminum conductor from electrical service to disconnect switch (where local codes permit use of aluminum wire), make connections in accordance with National Electrical Code. Prepare all aluminum wire immediately before installation by brush-scratching the wire, then coating the wire with a corrosion inhibitor (such as Pentrox A). Be sure entire connection is completely covered to prevent an electrochemical reaction that will cause connection to fail very quickly. Do not reduce effective size of wire by cutting off strands to fit wire into a connector. Always use properly sized connectors.

**HIGH-VOLTAGE CONNECTIONS** — Unit must have a separate electrical service with a field-supplied, waterproof, fused disconnect switch per NEC mounted near, and within sight from, the unit. Refer to unit rating plate for maximum fuse size and minimum circuit amps (ampacity) for wire sizing. Table 3 shows recommended wire sizes and lengths based on rating plate data.

The field-supplied disconnect switch box may be mounted on unit over the high-voltage inlet hole in control corner panel. See Fig. 4.

**WARNING:** Label Part No. A74191B, which is shipped loose in bag of parts, *must be affixed* to the disconnect switch box. This label states: **"DO NOT DISCONNECT THE ELECTRICAL POWER TO THIS APPLIANCE WITHOUT FIRST TURNING OFF THE GAS SUPPLY."**

Proceed as follows to complete the high-voltage connections to unit:

1. Connect ground lead to chassis ground connection when using a separate ground wire.
2. Run high-voltage leads into unit control box and connect to contactor. See unit wiring label and Fig. 6 and 8.

**NOTE:** On 3-phase units, connect third high-voltage lead to brown high-voltage pigtail lead. See unit wiring label and Fig. 8.

#### SPECIAL PROCEDURES FOR 208-V OPERATION

**WARNING:** Make sure power supply to unit is switched OFF before making any wiring changes.

For operation on 208 volts, disconnect orange transformer-primary lead from contactor. See unit wiring label and Fig. 6. Remove tape and cover from terminal on end of red transformer-primary lead. Save cover. Connect red lead to contactor terminal from which orange lead was disconnected.

Table 3 — Electrical Data (60 Hz)

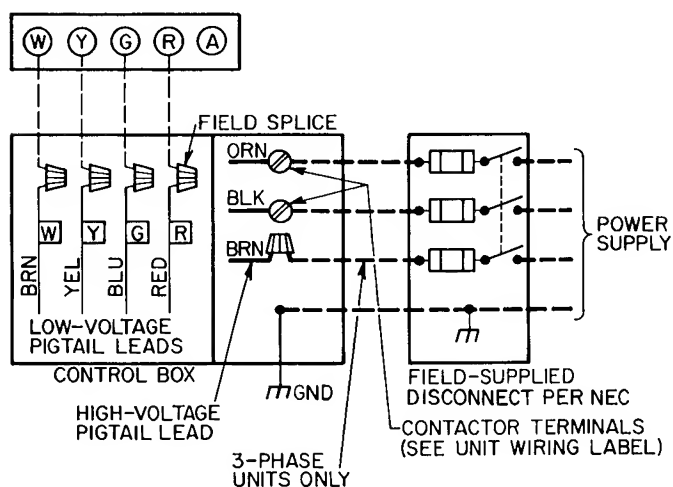
MODEL 48—	SERIES	V-PH	OPER VOLTAGE RANGE		FULL LOAD AMPS	MAX FUSE SIZE (Amps)	MINIMUM AMPACITY FOR WIRE SIZING	MINIMUM WIRE SIZE (AWG) (60 or 75 C Copper)*	MAX WIRE LENGTH (ft)*
			Min	Max					
KL018	300BE	208-230-1	197	253	11.5	20	13.9	14	70
KL024	300BE	208-230-1	197	253	17.2	30	20.9	10	120
KH024	300BE	208-230-1	197	253	18.5	30	22.2	10	110
KL030	300BE	208-230-1	197	253	19.8	35	23.8	10	102
KH030	300BE	208-230-1	197	253	19.6	35	23.6	10	102
KL036	300BE	208-230-1	197	253	24.3	40	29.0	10	83
	500CE	208/230-3	187	253	17.4	35	20.4	10	143
	600CE	460-3	414	506	7.6	15	8.9	14	310
KH036	300BE/BF	208-230-1	197	253	23.3	40	28.0	10	88
	500CE/CF	208/230-3	187	253	18.3	35	21.3	10	135
KL042	300BE	208-230-1	197	253	28.8	50	35.0	8	115
	500CE	208/230-3	187	253	21.9	40	25.8	10	115
KH042	300BE	208-230-1	197	253	28.6	50	34.6	8	112
	500CE	208/230-3	187	253	21.3	40	25.2	10	118
KL048	300BE	208-230-1	197	253	30.1	50	36.0	8	105
	500CE	208/230-3	187	253	24.8	40	28.5	10	103
	600CE	460-3	414	506	11.5	20	13.2	14	200
KH048	300BE/BF	208-230-1	197	253	29.3	50	35.2	8	108
	500CE/CF	208/230-3	187	253	22.8	40	26.5	10	110
KL060	300BE	230-1	207	253	35.9	60	42.9	(6)[8]†	(155)[100]†
KH060	300BE/BF	230-1	207	253	36.2	60	43.2	(6)[8]†	(150)[120]†

\*Wire sizes are based on 60 or 75 C copper wire at 86 F (30 C) ambient temperature and the minimum ampacity. If other than 60 or 75 C copper wire is used, if the ambient temperature is above 86 F (30 C), or if the voltage drop of the wire exceeds 2% of the total rated voltage, determine the wire size from the minimum

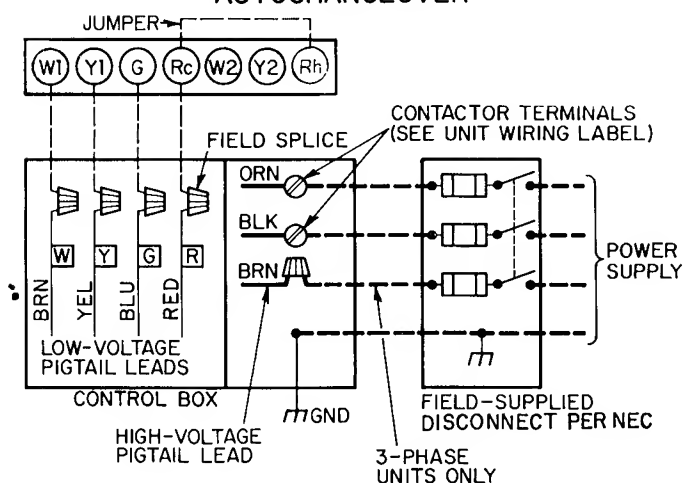
ampacity shown and the National Electrical Code. Wire lengths shown are measured one way along the wire path between the unit and service panel.

†Data in parentheses are based on 60 C copper wire. Data in brackets are based on 75 C copper wire.

### SINGLE-STAGE HEAT & COOL- MANUAL CHANGEOVER



### SINGLE-STAGE HEAT & COOL- AUTOCHANGEOVER



----- Field Low-Voltage Wiring  
 ----- Field High-Voltage Wiring  
 ----- Factory Low-Voltage Wiring  
 ----- Factory High-Voltage Wiring

NOTE For manual changeover applications, use thermostat part no. HH01AD042 with subbase part no. HH93AZ042; or thermostat part no. HH01AD040 with subbase part no. HH93AZ040.

For automatic changeover, use thermostat part no. HH07AT174 with subbase part no. HH93AZ096; or thermostat part no. HH10AD041 with subbase part no. HH93AZ041.

Fig. 8 — High- and Low-Voltage Connections



Using cover removed from red lead, insulate loose terminal on orange lead. Wrap cover with electrical tape so that metal terminal cannot be seen.

NOTE: For some 48KH, KL units, the factory-wired blower-motor speed connections may require changing for 208-v operation to ensure adequate air-flow at the rated external static pressure. See unit wiring label. Insulate all unused motor leads following same procedures described for transformer leads.

**LOW-VOLTAGE CONNECTIONS** — Use a suitable room thermostat as specified on unit wiring label.

Locate room thermostat on an inside wall in space to be conditioned where it will not be subjected to either a cooling or heating source, or direct exposure to sunlight. Mount thermostat 4 to 5 ft above floor.

Use no. 18 AWG color-coded, insulated (35 C minimum) wires to make low-voltage connections between thermostat and unit. If thermostat is located more than 100 ft from unit (as measured along the low-voltage wires), use no. 16 AWG color-coded, insulated (35 C minimum) wires.

A grommited, low-voltage inlet hole is located in the panel adjacent to control access panel. See Fig. 4. Run low-voltage leads from thermostat, thru inlet hole and to low-voltage flagged pigtail leads that run thru a hole in bottom of unit control box. See Fig. 6. Connect thermostat leads to pigtail leads as shown in Fig. 8.

**HEAT ANTICIPATOR SETTING** — Room thermostat heat anticipator must be properly adjusted to ensure proper heating performance. Set heat anticipator, using ammeter to determine exact required setting.

NOTE: For thermostat selection purposes, use 0.85 amps for approximate required setting.

Failure to make a proper heat anticipator adjustment will result in improper operation, discomfort to occupants of conditioned space and inefficient energy use; however, required setting may be changed slightly to provide a greater degree of comfort for a particular installation.

## START-UP

### Unit Preparation

**WARNING:** Failure to observe the following warnings could result in serious personal injury.

1. Follow recognized safety practices and wear protective goggles when checking or servicing refrigerant system.
2. Do not operate compressor or provide any electric power to unit unless compressor terminal cover is in place and secured.
3. Do not remove compressor terminal cover until all electrical sources have been disconnected.

4. Relieve all pressure from system before touching or disturbing anything inside terminal box if a refrigerant leak is suspected around compressor terminals.
5. Never attempt to repair a soldered connection while refrigerant system is under pressure.
6. Do not use a torch to remove any component. System contains oil and refrigerant under pressure. To remove a component, wear protective goggles and proceed as follows:
  - a. Shut off gas supply *first*, and *then* electrical power to unit.
  - b. Relieve all pressure from system.
  - c. Use tubing cutter to cut tubing that connects component, and remove component from unit.
  - d. Carefully unsweat remaining tubing stubs when necessary. Oil can ignite when exposed to torch flame.

**PRE-START-UP PROCEDURES** — Proceed as follows to inspect and prepare unit for initial start-up:

1. Remove all access panels.
2. Read and follow instructions on all **WARNING**, **CAUTION** and **INFORMATION** labels attached to or shipped with the unit, such as blower rotation labels, etc.
3. Remove these shipping components on the following sizes of Models 48KH, KL.
  - a. 030 and 036 sizes — remove styrofoam block wedged between header and unit side panel.
  - b. 048 size — remove shipping clamps that hold compressor to unit base.
  - c. 060 size — remove styrofoam block wedged between compressor and unit divider panel.
4. Make following inspections:
  - a. Inspect for shipping and handling damages such as broken lines, loose parts, disconnected wires, etc.
  - b. Inspect for oil at all refrigerant tubing connections and on unit base. The presence of oil generally indicates a refrigerant leak. Leak-test all refrigerant tubing connections using electronic leak detector, halide torch or liquid-soap solution. If refrigerant leak is detected, see Refrigerant Leaks in next part of this section.
  - c. Inspect all field- and factory-wiring connections. Be sure connections are completed and tight.
  - d. Inspect coil fins. If damaged during shipping and handling, carefully straighten fins with a fin comb.

**WARNING:** Do not purge gas supply into combustion chamber. Do not use a match or other open flame to check for gas leaks.

5. Verify the following conditions:
  - a. Make sure gas supply has been purged, and all gas piping has been checked for leaks.
  - b. Make sure outdoor fan blade is correctly positioned in fan orifice. *Blades should clear fan motor by no more than 1/4 inch.*
  - c. Make sure air filter(s) is in place.
  - d. Make sure condensate drain pan is filled with water to ensure proper drainage.
  - e. Make sure all tools and miscellaneous loose parts have been removed.
6. Replace all access panels. Unit is now ready for initial start-up.

**REFRIGERANT LEAKS** — Proceed as follows to repair a refrigerant leak and to charge the unit.

**WARNING:** Never attempt to repair a soldered connection while refrigerant system is under pressure. Severe bodily injury may result. Always wear protective goggles when servicing the refrigerant system.

1. Locate leak and ensure that refrigerant system pressure has been relieved.
2. Repair leak following accepted practices.

**NOTE:** Install a filter drier whenever system has been opened for repair.

3. Add a small charge of R-22 refrigerant vapor to system and leak-test unit.
4. Evacuate refrigerant system if additional leaks are not found.
5. Charge unit with R-22 refrigerant, using a volumetric-charging cylinder, such as Dial-a-Charge, or accurate scale. *Refer to unit rating plate for required charge.* Be sure to add extra refrigerant to compensate for internal volume of filter drier.

**NOTE:** See Cooling Section Start-Up and Adjustments — Checking and Adjusting Refrigerant Charge.

### Heating Section Start-Up and Adjustments

**CAUTION:** Complete required procedures given in Unit Preparation section before starting unit.

Do not jumper any safety devices when operating unit.

Ensure that burner orifices are properly aligned. Unstable operation may occur when the burner orifices in the manifold are misaligned. To ensure correct burner orifice alignment, check orifice angle with a machinist's protractor or other suitable device. The orifice angle must be from horizontal to 3 degrees down, as measured from unit base.

Follow instructions on heating section operation label (located in unit near the gas valve) or in Owner's Manual, to start the heating section.

**CHECKING HEATING CONTROL OPERATION** — Start and check unit for proper heating control operation as follows:

Place room thermostat selector switch in HEAT position and fan switch in AUTO. position. Set heating temperature control of thermostat above room temperature. Observe that after built-in time delays, the pilot automatically lights, burners light and blower motor starts. Observe that burners and pilot are extinguished, and that after a built-in delay, blower motor stops when heating control setting of thermostat is satisfied.

### GAS INPUT

**CAUTION:** These units are designed to consume the rated gas inputs using the fixed orifices at specified manifold pressures as shown in Table 4. **DO NOT REDRILL ORIFICES UNDER ANY CIRCUMSTANCES.**

The rated gas inputs shown in Table 4 are for altitudes from sea level up to 2000 ft above sea level. These inputs are based on natural gas with a heating value of 1050 Btu/cu ft at 0.65 specific gravity, or LP (propane) gas with a heating value of 2500 Btu/cu ft at 1.5 specific gravity. For elevations above 2000 ft, reduce input 4% for each 1000 ft above sea level. When gas supply being used has a different heating value or specific gravity, refer to Carrier training manuals, national and local codes, or contact your Carrier distributor or dealer to determine required orifice size.

**ADJUSTING GAS INPUT** — The gas input to unit is determined by measuring the gas flow at the meter or by measuring the manifold pressure. Measuring the gas flow at the meter is recommended for natural gas units. Manifold pressure must be measured to determine the input of LP (propane) gas units.

Measuring Gas Flow at Meter Method — Natural Gas Units — Minor adjustment can be made by changing manifold pressure. Manifold pressure must be maintained between 3.2 and 3.8 in. wg. If larger adjustments are required, change main burner orifices following recommendations of national and local codes.

**NOTE:** All other appliances that use the same meter must be turned off when gas flow is measured at meter.

Proceed as follows:

1. Turn off gas supply to unit.
2. Remove pipe plug on gas valve outlet identified as PRESS. TAP, then connect water manometer at this point. Turn on gas to unit.
3. Record number of seconds for gas meter test dial to make one revolution.
4. Divide number of seconds in step 3 into 3600 (number of seconds in 1 hour).

5. Multiply result of step 4 by the number of cu ft shown for one revolution of test dial to obtain cu ft of gas flow per hour.
6. Multiply result of step 5 by Btu heating value of gas to obtain total measured input in Btuh. Compare this value with heating input shown in Table 4. Consult local gas supplier if the heating value of gas is not known.

Example: Assume that the size of test dial is 1 cu ft, one revolution takes 30 seconds and the heating value of the gas is 1050 Btu per cu ft, then proceed as follows:

- a. 30 seconds to complete one revolution.
- b. 30 divided into 3600 equals 120.
- c. 120 times one equals 120 cu ft of gas flow per hour.
- d. 120 times 1050 equals 126,000 Btuh input.

If the desired gas input is 125,000 Btuh, only a minor change in the manifold pressure is required.

Observe manifold pressure and proceed as follows to adjust gas input:

1. Remove vented seal cap over REG ADJ screw on gas valve.
2. Turn regulator adjustment screw clockwise to increase gas input, or turn regulator adjustment screw counterclockwise to decrease input. Manifold pressure must be between 3.2 and 3.8 in. wg. **UNSAFE OPERATION OF THE UNIT MAY RESULT IF MANIFOLD PRESSURE IS OUTSIDE THIS RANGE.**
3. Replace vented seal cap on gas valve.
4. Turn off gas supply to unit. Remove manometer from pressure tap. Replace pipe plug on gas valve. Turn on gas to unit. Check for leaks.

**Measuring Manifold Pressure — LP (Propane) Gas Units** — The main burner orifices on a propane gas unit are sized for the unit rated input when manifold pressure is 10.5 in. wg.

Proceed as follows to adjust gas input on an LP (propane) gas unit:

1. Turn off gas to unit.
2. Remove pipe plug on gas valve outlet identified as PRESS. TAP, then connect manometer at this point.
3. Turn on gas to unit.
4. Remove vented seal cap over REG ADJ screw on gas valve.
5. Adjust regulator adjustment screw for a manifold pressure reading of 10.5 in. wg. Turn adjusting screw clockwise to increase manifold pressure, or turn adjusting screw counterclockwise to decrease manifold pressure.
6. Turn off gas to unit. Remove manometer from pressure tap. Replace pipe plug on gas valve, then turn on gas to unit. Check for leaks.

#### ADJUSTING BURNER AIR SHUTTERS —

After burners have operated at full input for at least 10 minutes, adjust primary air to each burner to ensure optimum heating performance. Make these adjustments when unit is being installed and during routine maintenance inspections at beginning of each heating season. *Be sure each burner is clean and free of deposits before adjusting primary air.*

Primary air to each burner is regulated by burner air shutter on each burner. See Fig. 9 for location of burner air shutter. With all burners operating, adjust primary air to each burner as follows:

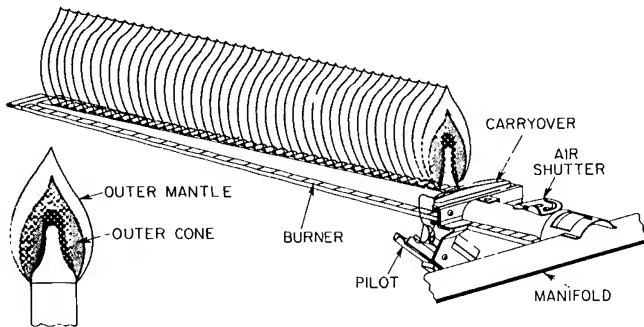
1. Loosen locking screw that secures air shutter in place on burner, then partially close air shutter until a slight yellow tip appears on top of burner flames.
2. Open air shutter *very slowly* until yellow tip just disappears, then secure air shutter in place with locking screw.
3. Repeat steps 1 and 2 for each burner.

**Table 4 — Rated Gas Inputs at Indicated Manifold Pressures**

MODEL 48—	NUMBER OF ORIFICES	GAS SUPPLY PRESSURE (in. wg)				MANIFOLD PRESSURE (in. wg)		NATURAL GAS		LP (Propane) GAS	
		Natural		LP (Propane)		Natural	LP (Prop.)	Orifice P/N	Heating Input (Btuh)*	Orifice P/N	Heating Input (Btuh)*
		Min	Max	Min	Max						
KL018,024,030	2	5.0	13.6	11.0	13.0	3.5	10.5	LH32DB205	40,000	LH32DB201	40,000
KH024,030 KL036,042	3	5.0	13.6	11.0	13.0	3.5	10.5	LH32DB205	60,000	LH32DB201	60,000
KH042, KL048	4	5.0	13.6	11.0	13.0	3.5	10.5	LH32DB200	80,000	LH32DB201	80,000
KH036,048 KL060	5	5.0	13.6	11.0	13.0	3.5	10.5	LH32DB200	100,000	LH32DB201	100,000
KH036BF/CF KH048BF/CF	5	5.0	13.6	11.0	13.0	3.5	10.5	LH32DB207	125,000	Not Available	
KH060BE	6	5.0	13.6	11.0	13.0	3.5	10.5	LH32DB200	120,000	LH32DB201	120,000
KH060BF	6	5.0	13.6	11.0	13.0	3.5	10.5	LH32DB207	150,000	Not Available	

\*Based on altitudes from sea level up to 2000 feet above sea level. For altitudes above 2000 feet, reduce input rating 4% for each 1000 feet above sea level.

After air shutter adjustments have been completed, observe that flames on each burner are light blue and soft in appearance, and that flames are same height along entire length of each burner. See Fig. 9.



**Fig. 9 — Burner Flames**

**BLOWER HEAT-RELAY OPERATION** — Heating relay (see Fig. 6 and unit wiring diagram) is located in the control box and adjusts to permit either longer or shorter OFF cycles. The ON cycle automatically adjusts as OFF cycle changes. Adjusting lever on relay is factory-set at center position to provide optimum performance for most installations. On unusual installations, or where line voltage is considerably above or below rated voltage, an increase or decrease may be required for length of time blower remains on. To increase blower operation time, move adjusting lever toward right-hand position. To decrease blower operation time, move lever toward left-hand position.

**AIRFLOW AND TEMPERATURE RISE** — The heating section of each size of unit is designed and approved for heating operation within temperature rise range stamped on unit rating plate.

Table 5 shows approved temperature rise range for each unit and air delivery (cfm) at various temperature rises. Heating operation airflow must produce a temperature rise that falls within the approved range. Refer to Cooling Section Start-up and Adjustments — Indoor Airflow and Airflow Adjustments to adjust heating airflow when required.

**HEATING SEQUENCE OF OPERATION** — The following sequence of operation pertains to all 208/230-volt, 3-phase units; however, the sequence of operation of single-phase and 460-volt units is very similar. Refer to the wiring diagram in Fig. 10.

**NOTE:** Although actual unit wiring may vary slightly from that shown in Fig. 10, sequence of operation will not be affected.

With room thermostat selector switch at HEAT position and FAN switch at AUTO. position, heating sequence of operation is as follows:

Models 48KH, KL have an intermittent electric-spark ignition system without a standing flame. When manual control valve is opened, gas flows to solenoid valve chamber of gas valve. Unit is now in a standby condition and ready for a call for heat from room thermostat.

When room temperature drops to a point slightly below heating control setting of room thermostat, the thermostat heating bulb tilts and completes circuit between thermostat terminals R and W. This completed circuit between R and W thru the room

**Table 5 — Air Delivery (cfm) at Indicated Temperature Rise and Rated Heating Input**

MODEL 48—	Heating Input (Btuh)	Temperature Rise (°F)*																	
		35	37	39	41	43	45	47	49	51	53	55	57	59	61	63	65	67	69
KL018	40,000	794	751	712	678	646	617	591	567	545	524	505	487	471	455	441	427	—	—
KL024	40,000	794	751	712	678	646	617	591	567	545	—	—	—	—	—	—	—	—	—
KH024	60,000	1190	1126	1068	1016	969	926	887	850	817	786	758	731	706	—	—	—	—	—
KL030	40,000	794	751	712	678	646	617	591	567	545	524	505	487	471	455	—	—	—	—
KH030	60,000	1190	1126	1068	1016	969	926	887	850	817	786	758	—	—	—	—	—	—	—
KL036	60,000	1190	1126	1068	1016	969	926	887	850	817	786	758	731	706	683	—	—	—	—
KH036	100,000	1984	1877	1781	1694	1615	1543	1478	1417	1362	1310	1263	1218	1177	1138	1102	1068	1036	1006
KH036BF/CF	125,000	—	—	—	2202	2095	2006	1921	1842	1770	1703	1641	1584	1530	1480	1433	1389	1347	1308
KL042	60,000	1190	1126	1068	1016	969	926	887	850	817	786	758	731	706	683	661	641	622	604
KH042	80,000	1587	1502	1425	1356	1292	1235	1182	1134	1089	1048	1010	975	942	911	—	—	—	—
KL048	80,000	1587	1502	1425	1356	1292	1235	1182	1134	1089	1048	1010	975	942	911	—	—	—	—
KH048	100,000	1984	1877	1781	1694	1615	1543	1478	1417	1362	1310	1263	1218	1177	1138	1102	—	—	—
KH048BF/CF	125,000	—	—	—	2345	2202	2069	2006	1921	1842	1770	1703	1641	1584	1530	1480	1433	1389	1347
KL060	100,000	1984	1877	1781	1694	1615	1543	1478	1417	1362	1310	1263	1218	1177	1138	1102	—	—	—
KH060	120,000	2361	2252	2157	2063	1978	1892	1812	1737	1664	1592	1521	1462	1412	1366	1323	1282	1244	1208
KH060BF	150,000	—	—	—	—	2513	2407	2305	2211	2124	2044	1970	1901	1836	1776	1720	1667	1617	1570

**NOTE:** Shaded areas of the table fall below the approved temperature rise range of the unit. Dashed areas of the table fall beyond the air delivery capability of the unit within the operating voltage range for all voltage options for each size unit.

\*Single-phase units. Temperature rise for 3-phase units may be different due to blower motor performance. For 3-phase units use:

$$\text{Temperature Rise} = \frac{\text{Capacity}}{1.08 \times \text{cfm}}$$





**Table 6 — Model 48KH,KL Air Delivery (cfm)\*  
at Indicated External Static Pressure and Voltage**

MODEL 48-	UNIT VOLTS— PHASE (60 Hz)	BLOWER MOTOR SPEED	COIL†	EXTERNAL STATIC PRESSURE (in wg)																	
				208V								230V or 460V									
				0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
KL018	208-230—1	Low	Heat Cool†	740 700	700 665	660 625	615 580	565 535	510 480	—	—	—	805 760	765 720	725 680	675 635	625 585	565 525	—	—	—
		High	Heat Cool	795 745	750 705	705 665	660 620	610 570	555 520	—	—	—	870 810	825 775	780 730	735 690	685 640	630 590	—	—	—
KL024	208-230—1	Low	Heat Cool	895 865	850 820	800 775	750 725	700 675	645 620	—	—	—	950 920	905 875	855 825	800 770	745 715	680 650	—	—	—
		High	Heat Cool†	980 940	930 895	875 845	820 790	760 730	700 665	—	—	—	1030 985	975 935	920 885	865 835	810 780	755 725	—	—	—
KH024	208-230—1	Low	Heat Cool†	995 935	925 900	890 870	855 835	815 800	780 765	—	—	—	1030 1000	990 965	955 935	920 890	880 860	840 820	—	—	—
		High	Heat Cool	1125 1080	1075 1035	1030 990	980 950	930 900	880 855	—	—	—	1160 1120	1115 1075	1065 1030	1015 980	965 935	915 885	—	—	—
KL030	208-230—1	Low	Heat Cool	700 690	680 670	655 650	635 630	610 605	585 580	—	—	—	850 835	820 810	795 785	765 755	735 725	705 695	—	—	—
		High	Heat Cool†	1325 1270	1270 1220	1210 1165	1150 1110	1090 1045	1020 975	—	—	—	1370 1305	1310 1245	1245 1190	1180 1125	1110 1060	1035 990	—	—	—
KH030	208-230—1	Low	Heat Cool†	1125 1085	1070 1035	1015 985	955 925	900 870	840 815	—	—	—	1175 1130	1115 1070	1050 1010	985 950	925 890	855 830	—	—	—
		High	Heat Cool	1225 1175	1165 1120	1105 1065	1040 1005	980 945	915 885	—	—	—	1260 1205	1200 1155	1140 1100	1080 1040	1020 985	955 925	—	—	—
KL036	208-230—1	Low	Heat Cool	950 945	945 940	940 935	930 925	915 910	900 890	—	—	—	1250 1210	1205 1165	1160 1125	1115 1080	1065 1035	1015 990	—	—	—
		High	Heat Cool†	1570 1475	1500 1410	1425 1345	1355 1275	1280 1205	1200 1140	—	—	—	1610 1510	1540 1450	1470 1390	1400 1325	1330 1260	1255 1190	—	—	—
	208/ 230—3	Low	Heat Cool	1165 1155	1155 1145	1140 1125	1125 1110	1100 1085	1075 1050	1040 1015	995 960	930 855	1365 1345	1345 1320	1320 1295	1295 1265	1265 1235	1225 1190	1180 1135	1120 1060	1020 900
		High	Heat Cool†	1525 1475	1490 1440	1450 1405	1415 1370	1375 1325	1330 1280	1280 1225	1220 1155	1135 1045	1620 1560	1580 1520	1540 1475	1495 1435	1450 1390	1405 1345	1355 1295	1300 1235	1230 1155
KH036	460—3	Low	Heat Cool	—	—	—	—	—	—	—	—	—	1185 1165	1175 1155	1160 1135	1135 1120	1110 1095	1095 1060	1060 1015	1005 970	940 895
		High	Heat Cool†	—	—	—	—	—	—	—	—	—	—	1535 1485	1500 1450	1460 1415	1425 1380	1385 1335	1340 1290	1290 1235	1230 1165
	208-230—1	Low	Heat Cool†	1280 1265	1260 1245	1240 1220	1215 1195	1190 1165	1160 1130	—	—	—	1510 1475	1480 1440	1445 1395	1400 1345	1340 1280	1275 1210	—	—	—
		High	Heat Cool	1825 1735	1765 1700	1700 1595	1630 1515	1540 1410	1425 1270	—	—	—	1905 1790	1845 1725	1775 1655	1700 1565	1595 1455	1475 1320	—	—	—
	208/ 230—3	Low	Heat Cool†	1275 1270	1270 1260	1260 1245	1240 1225	1220 1205	1195 1175	1165 1145	1135 1110	1100 1075	1505 1490	1490 1470	1470 1445	1445 1415	1415 1375	1375 1330	1330 1285	1280 1235	1230 1185
		Med	Heat Cool	1625 1590	1605 1565	1575 1530	1540 1490	1500 1445	1455 1395	1400 1350	1350 1300	1295 1245	1845 1770	1805 1725	1760 1675	1710 1625	1655 1575	1595 1520	1535 1465	1480 1405	1415 1350
		High	Heat Cool	2035 1915	1980 1860	1920 1800	1855 1740	1785 1675	1715 1610	1645 1545	1570 1480	1495 1410	2130 1995	2070 1940	2010 1875	1940 1815	1870 1745	1800 1680	1725 1615	1645 1545	1570 1475
		208-230—1	Low	Heat Cool	855 855	850 845	835 830	820 815	795 790	760 750	—	—	—	1035 1030	1025 1020	1010 1005	995 990	975 965	950 935	—	—
High	Heat Cool†		1700 1635	1635 1575	1565 1505	1495 1440	1425 1375	1355 1305	—	—	—	1770 1695	1705 1630	1635 1560	1555 1480	1470 1405	1385 1325	—	—	—	
KL042	208/ 230—3	Low	Heat Cool	970 965	965 960	960 955	945 940	935 930	910 905	880 870	835 820	780 765	1190 1190	1185 1180	1175 1170	1165 1155	1145 1135	1120 1105	1080 1055	1020 990	940 910
		High	Heat Cool†	2040 1950	1980 1890	1915 1835	1850 1770	1785 1705	1715 1635	1640 1555	1550 1465	1450 1380	2145 2030	2080 1970	2010 1905	1940 1840	1865 1770	1790 1695	1705 1610	1610 1515	1500 1400
	208-230—1	Low	Heat Cool	1410 1390	1385 1365	1355 1330	1315 1280	1255 1215	1175 1120	—	—	—	1580 1535	1530 1485	1475 1435	1420 1380	1360 1315	1290 1240	—	—	—
		High	Heat Cool†	1705 1650	1650 1590	1590 1535	1525 1465	1450 1390	1365 1300	—	—	—	1770 1705	1710 1640	1645 1580	1575 1510	1500 1435	1415 1345	—	—	—
KH042	208/ 230—3	Low	Heat Cool	1405 1400	1400 1395	1395 1385	1385 1370	1365 1345	1335 1310	1295 1260	1240 1145	1175 1110	1650 1630	1635 1605	1610 1575	1585 1540	1545 1495	1500 1445	1445 1385	1380 1320	1305 1250
		High	Heat Cool†	1725 1705	1710 1685	1685 1655	1655 1615	1615 1570	1565 1515	1505 1455	1440 1390	1370 1320	1935 1870	1885 1820	1835 1770	1780 1720	1730 1665	1670 1610	1610 1550	1540 1470	1455 1360
	208-230—1	Low	Heat Cool	—	—	—	—	—	—	—	—	—	1350 1350	1340 1340	1330 1325	1310 1300	1275 1255	1190 1120	—	—	—
		High	Heat Cool†	—	—	—	—	—	—	—	—	—	—	1920 1860	1845 1790	1770 1725	1695 1655	1625 1585	1550 1515	—	—
KL048	208/ 230—3	Low	Heat Cool	1150 1150	1150 1150	1150 1150	1150 1150	1150 1150	1150 1150	1145 1140	1135 1130	1115 1110	1395 1395	1395 1395	1395 1390	1385 1380	1370 1365	1355 1350	1330 1320	1300 1285	—
		Med	Heat Cool	1805 1800	1800 1790	1785 1770	1765 1745	1735 1715	1700 1680	1665 1640	1625 1605	1585 1565	2080 2050	2050 2020	2015 1975	1970 1930	1920 1880	1865 1820	1805 1765	1745 1705	1680 1640
	460—3	Low	Heat Cool†	2200 2155	2155 2110	2110 2060	2055 2005	2000 1950	1940 1890	1880 1835	1815 1775	1755 1710	2325 2265	2275 2215	2220 2160	2160 2100	2095 2040	2030 1975	1965 1910	1895 1840	1825 1770
		High	Heat Cool	—	—	—	—	—	—	—	—	—	—	1500 1490	1480 1470	1460 1450	1435 1425	1410 1395	1380 1370	1350 1340	1325 1310
KH048	208-230—1	Low	Heat Cool	—	—	—	—	—	—	—	—	—	1790 1750	1730 1690	1665 1630	1600 1565	1530 1495	1450 1410	—	—	—
		High	Heat Cool†	—	—	—	—	—	—	—	—	—	—	1975 1915	1900 1845	1820 1770	1745 1695	1665 1625	1590 1550	—	—

**Table 6 — Model 48KH,KL Air Delivery (cfm)\*  
at Indicated External Static Pressure and Voltage (Cont)**

MODEL 48-	UNIT VOLTS— PHASE (60 Hz)	BLOWER MOTOR SPEED	COIL†	EXTERNAL STATIC PRESSURE (in wg)																			
				208V								230V or 460V											
				0 0	0 1	0 2	0 3	0 4	0 5	0 6	0 7	0 8	0 0	0 1	0 2	0 3	0 4	0 5	0 6	0 7	0 8		
KH048	208/ 230—3	Low	Heat	1440	1435	1425	1415	1400	1385	1365	1340	1305	1730	1720	1700	1675	1645	1610	1560	1520	1470		
			Cool	1435	1430	1420	1410	1395	1380	1355	1330	1290	1725	1710	1685	1660	1625	1585	1545	1495	1445		
		Med	Heat	1755	1740	1725	1700	1665	1625	1580	1530	1470	1970	1945	1910	1875	1825	1775	1720	1660	1600		
			Cool†	1745	1730	1710	1680	1645	1600	1550	1500	1440	1950	1920	1880	1840	1790	1735	1685	1625	1570		
		High	Heat	1950	1920	1880	1840	1795	1750	1700	1645	1590	2175	2130	2085	2030	1970	1905	1840	1765	1695		
			Cool	1925	1890	1850	1810	1765	1715	1665	1615	1560	2130	2085	2035	1980	1920	1855	1790	1720	1650		
KL060	230—1	Low	Heat†	—	—	—	—	—	—	—	—	—	—	1585	1585	1580	1560	1530	1495	—	—	—	
			Cool	—	—	—	—	—	—	—	—	—	—	1585	1585	1575	1550	1515	1475	—	—	—	
		High	Heat	—	—	—	—	—	—	—	—	—	—	—	2375	2280	2185	2095	2000	1905	—	—	—
			Cool†	—	—	—	—	—	—	—	—	—	—	—	2270	2185	2100	2015	1930	1840	—	—	—
KH060	230—1	Low	Heat	—	—	—	—	—	—	—	—	—	—	1880	1875	1860	1825	1770	1700	—	—	—	
			Cool	—	—	—	—	—	—	—	—	—	—	1875	1865	1840	1790	1725	1650	—	—	—	
		Med	Heat†	—	—	—	—	—	—	—	—	—	—	—	2130	2075	2015	1955	1890	1810	—	—	—
			Cool	—	—	—	—	—	—	—	—	—	—	—	2075	2025	1965	1900	1835	1760	—	—	—
		High	Heat	—	—	—	—	—	—	—	—	—	—	—	2345	2260	2180	2095	2010	1930	—	—	—
			Cool†	—	—	—	—	—	—	—	—	—	—	—	2255	2175	2100	2020	1945	1865	—	—	—

\*Air delivery values are without air filter. Deduct field-supplied air filter pressure drop to obtain external static pressure available for ducting.

†Heating airflow values are with a dry coil. Cooling airflow values are with a wet coil.

‡These airflow values are at the factory heating and cooling blower motor speed setting.

A dash (—) indicates portions of the table that are beyond the blower motor capability or that are not applicable.

NOTE: Do not operate the unit at a cooling airflow that is less than 350 fpm per each 12,000 Btuh of rated cooling capacity. Indoor coil icing may occur at airflows below this point.

thermostat simultaneously energizes pilot valve (part of gas valve) and pilot igniter. Energized pilot gas valve permits gas to flow to pilot.

NOTE: Pilot gas valve is a solenoid consisting of a PICK and a HOLD coil. Both coils must be energized to open pilot gas valve, but only HOLD coil must be energized to keep valve open.

Energized pilot igniter sends a high-voltage charge to pilot electrode (part of pilot). Pilot electrode produces a spark that ignites pilot. Flame-sensing monometal switch in pilot proves presence of pilot flame. Approximately 40 to 60 seconds after pilot flame is established, normally closed contacts of pilot open and normally open contacts close. Switching of pilot contacts de-energizes pilot igniter and PICK coil of pilot solenoid. HOLD coil of pilot solenoid is still energized; therefore, pilot gas valve remains open and pilot remains lit.

**WARNING:** If pilot fails to light, do not attempt to manually light intermittent-type pilot with a match or other source of flame.

Switching of pilot contacts also completes low-voltage circuit to time-delay heat relay, and terminal no. 1 of gas valve. After approximately 10 seconds, heat-motor-operated gas valve opens and permits gas to flow to burners where gas is ignited by pilot. Ignited burners heat the heat exchanger.

After built-in time delay, normally open relay contacts of energized heat relay close, and circuit to blower motor is completed. Blower motor starts.

Heating cycle remains on until room temperature rises to a point that is slightly above heating control setting of room thermostat. At this point, thermostat heating bulb tilts and breaks circuit between thermostat terminals R and W. Gas flow thru gas valve

stops and burner flames go out. Gas flow thru pilot gas valve also stops and pilot flame goes out.

Time-delay heat relay de-energizes; however, there is a built-in delay before heat relay contacts open, and blower continues to move air across heat exchanger to help optimize heating efficiency. When heat relay contacts open, circuit to blower motor breaks and motor stops.

Unit is in a standby condition, waiting for next call for heat from thermostat.

**LIMIT AND PRESSURE SWITCHES** — Furnace limit switch (see Fig. 10) closes gas valve if leaving-air temperature exceeds 175 F.

Normally closed limit switch completes control circuit thru pigtail lead W to gas valve 5 F. See Fig. 10. Should leaving-air temperature rise to 175 F, switch opens and W control circuit breaks. Any interruption in W control circuit instantly closes gas valve and stops gas flow to burners and pilot. Blower motor continues to run until time-delay sequence of heat relay is completed.

When air temperature at limit switch drops to the low-temperature setting of limit switch, switch closes and completes W control circuit. Electric-spark ignition system cycles and unit returns to normal heating operation.

Pressure switch (see Fig. 10) is required only when unit operates on LP (propane) gas.

**BLOWER SAFETY SWITCH** — Blower safety switch is a temperature-actuated switch connected parallel with contacts of heat relay. Function of switch is to activate blower should gas valve fail to close when thermostat is satisfied. Safety switch is mounted on blower divider panel. When temperature at safety switch reaches approximately 175 F, switch closes to start blower. Switch opens when temperature at switch drops to approximately 116 F.

## Cooling Section Start-Up and Adjustments

**CAUTION:** Complete required procedures given in Unit Preparation section before starting unit.

Do not jumper any safety devices when operating unit.

Do not operate compressor when outdoor temperature is below 55 F (single-phase units) or 40 F (3-phase units).

Do not permit compressor to rapid cycle. Allow 5 minutes between cycles to prevent compressor damage.

**CHECKING COOLING CONTROL OPERATION** — Start and check unit for proper cooling control operation as follows:

1. Place room thermostat selector switch in OFF position. Observe that blower motor starts when fan switch is placed in ON position and shuts off when fan switch is placed in AUTO. position.
2. Place selector switch in COOL position and fan switch in AUTO. position. Set cooling control below room temperature. Observe that compressor, condenser fan and evaporator blower motors start. Observe that cooling cycle shuts down when control setting is satisfied.
3. When using an automatic changeover room thermostat, place both selector and fan switches in AUTO. position. Observe that unit operates in heating mode when temperature control is set to call for heating (above room temperature) and operates in cooling mode when temperature control is set to call for cooling (below room temperature).

**CHECKING AND ADJUSTING REFRIGERANT CHARGE** — Refrigerant system is fully charged with R-22 refrigerant, tested and factory sealed. For most applications, factory charge is the correct amount for best performance; however, this charge may require a slight adjustment to attain rated performance.

**NOTE:** Adjustment of refrigerant charge is not required unless unit is suspected of not having proper R-22 charge. For all applications, correct R-22 charge for best performance is charge that results in a suction gas superheat of 5 F at compressor inlet when unit is operating at ARI rating conditions of 95 F db outdoor and 80 F db/67 F wb indoor.

A superheat charging label is attached to outside of compressor access door. Label includes a Field Superheat Charging Table and a Required Suction-Tube (F) temperature chart.

An accurate superheat-, thermocouple-, or thermistor-type thermometer, a sling psychrometer and a gage manifold are required when using superheat charging method for evaluating unit charge.

*Do not use mercury or small dial-type thermometers because they are not adequate for this type of measurement.*

**CAUTION:** When evaluating refrigerant charge, an indicated adjustment to specified factory charge must always be minimal. If a substantial adjustment is indicated, an abnormal condition exists somewhere in cooling system, such as insufficient airflow across either coil or both coils.

Proceed as follows:

1. Remove caps from low- and high-pressure service fittings.
2. Using hoses with valve core depressors, attach low- and high-pressure gage hoses to low- and high-pressure service fittings, respectively.
3. Start unit in cooling mode and let unit run until system pressures stabilize.
4. Measure and record the following:
  - a. Outdoor ambient-air temperature (F db).
  - b. Evaporator inlet-air temperature (F wb).
  - c. Suction-tube temperature (F) at low-side service fitting.
  - d. Suction (low-side) pressure (psig).
5. Using Field Superheat Charging Table, compare outdoor-air temperature (F db) with evaporator inlet-air temperature (F wb) to determine desired system operating superheat temperature.
6. Using Required Suction-Tube (F) table, compare desired superheat temperature with suction (low-side) operating pressure (psig) to determine proper suction tube temperature.
7. Compare actual suction-tube temperature with proper suction tube temperature. Using a tolerance of  $\pm 5$  F, add refrigerant if actual temperature is more than 5 F higher than proper suction tube temperature, or remove refrigerant if actual temperature is more than 5 F lower than required suction-tube temperature.

**NOTE:** If the problem causing inaccurate readings is a refrigerant leak, see Unit Preparation, Refrigerant Leaks section of these instructions.

## INDOOR AIRFLOW AND ADJUSTMENTS

**CAUTION:** For cooling, recommended airflow is 350 to 450 cfm for each 12,000 Btu/h of rated cooling capacity. For heating, airflow must produce a temperature rise that falls within the range stamped on unit rating plate.

Models 48KH, KL end-discharge units have direct-drive blower motors. All motors are factory-connected to deliver proper heating and cooling airflows at normal external static pressures (except for some 208-v applications).

Table 5 shows heating airflow at various temperature rises. Table 6 shows both heating and cooling airflows at various external static pressures for Models 48KH, KL direct-drive units. Refer to these tables to determine airflow for system being installed. See Table 7 for rated cooling and heating airflows.

NOTE: Be sure all supply- and return-air grilles are open, free from obstructions and adjusted properly.

**WARNING:** Disconnect electrical power to unit before changing blower speed. Be sure to turn off gas supply before disconnecting electrical power.

NOTE: When operating the 208/230-volt, 3-phase version of Models 48KH048, 48KL060 and 48KH060 at 208 volts, lead connections of blower motor must be changed as indicated on unit wiring label to ensure proper airflow.

**CAUTION:** Do not change blower-motor lead connections on 460-v units from factory setting.

Heating and/or cooling airflow of 208/230-v direct-drive blower motors can be changed by changing the lead connections of blower motor. Motor leads are color-coded as follows:

*black* — high speed  
*blue* — medium speed  
*red* — low speed

NOTE: Some direct-drive blower motors do not have lead for medium speed. Factory connections and available optional connections are shown in Table 6.

For all units, motor lead connected to heat relay determines heating speed and resulting airflow; and motor lead connected to cooling relay determines the cooling speed and resulting airflow. See unit wiring label.

To change heating and/or cooling speed, connect appropriate color-coded lead to appropriate relay. Be sure to properly insulate any unused motor lead.

**Table 7 — Rated Cooling and Heating Airflows**

MODEL 48—	RATED COOLING AIRFLOW (cfm)*	EXTERNAL STATIC PRESSURE (in. wg)*	RATED HEATING AIRFLOW (cfm)
KL018300BE	600	0 10	555
KL024300BE	825	0 10	555
KH024300BE	825	0 10	835
KL030300BE	1088	0 15	465
KH030300BE	1088	0 15	835
KL036300BE	1200	0 15	835
KL036500CE	1200	0 15	835
KL036600CE	1200	0 15	835
KH036300BE	1215	0 15	1155
KH036300BF	1215	0 15	1445
KH036500CE	1215	0 15	1155
KH036500CF	1200	0 15	1445
KL042300BE	1400	0 15	695
KL042500CE	1400	0 15	695
KH042300BE	1400	0 15	925
KH042500CE	1400	0 15	925
KL048300BE	1600	0 20	925
KL048500CE	1600	0 20	925
KL048600CE	1600	0 20	925
KH048300BE	1600	0 20	1155
KH048300BF	1600	0 20	1445
KH048500CE	1600	0 20	1155
KH048500CF	1600	0 20	1445
KL060300BE	1980	0 20	1155
KH060300BE	1980	0 20	1155
KH060300BF	1980	0 20	1735

\*Rated in accordance with ARI Standard 210-81

See Make Wiring Connections, Special Procedures for 208-v Operation section for proper procedures to insulate an unused electrical lead.

When installing a 208- or 230-v direct-drive unit that is factory-connected for heating and cooling speeds that are not the same, and same speed for both heating and cooling is required for a particular application, connect appropriate color-coded lead to terminal 2 of cooling relay and connect a field-supplied jumper between heat relay and terminal 2 of cooling relay. Be sure to properly insulate unused motor lead(s).

**CONTROLS** — All compressors have the following internal-protection controls:

**High-Pressure Relief Valve** — This valve opens when pressure differential between low and high side becomes excessive.

**Compressor Overload** — This overload interrupts power to compressor when either current or internal temperature becomes excessive, and automatically resets when internal temperature drops to a safe level. This overload may require up to 60 minutes (or longer) to reset; therefore, if internal overload is suspected of being open, disconnect electrical power to unit and check circuit thru overload with an ohmmeter or continuity tester.

**COOLING SEQUENCE OF OPERATION** — The following sequence of operation pertains to all 208/230-volt, 3-phase units; however, sequence of operation of single-phase and 460-volt units is very similar. Refer to wiring diagram in Fig. 10.

**NOTE:** Although actual unit wiring may vary slightly from that shown in Fig. 10, sequence of operation will not be affected.

With room thermostat selector switch in the COOL position and fan switch in AUTO. position, cooling sequence of operation is as follows:

When room temperature rises to a point slightly above cooling control setting of thermostat, thermostat cooling bulb tilts and completes circuit between thermostat terminal R to terminals Y and G. These completed circuits thru the thermostat connect contactor coil (thru unit wire Y) and relay coil (thru unit wire G) across the 24-volt secondary of transformer.

The 2 sets of normally open contacts of energized contactor 2D close and complete circuit thru compressor motor 3F and condenser fan motor 3D1. Both motors start instantly.

The set of normally open contacts of energized relay closes and completes circuit thru evaporator blower motor. Blower motor starts instantly.

**NOTE:** Three-phase units are equipped with a 2-speed condenser fan motor and a temperature-actuated switch. Fan motor operates at high speed when outdoor temperature rises to  $75 \pm 3$  F and continues to operate at high speed until outdoor temperature drops to  $61 \pm 4$  F. At 61 F or lower, fan motor operates at low speed and permits cooling operation down to 40 F.

Cooling cycle remains on until room temperature drops to a point slightly below cooling control setting of room thermostat. At this point, thermostat cooling bulb tilts and breaks circuit between thermostat terminal R to terminals Y and G. These open circuits de-energize contactor coil and relay coil. Condenser, compressor and blower motors stop. Unit is in a standby condition, waiting for next call for cooling from room thermostat.

## SERVICE

To ensure continuing high performance, and to minimize possibility of premature equipment failure, periodic maintenance must be performed on this equipment. This combination heating/cooling unit should be inspected at least once each year by a qualified service person.

**NOTE TO EQUIPMENT OWNER:** Consult your local dealer about the availability of a maintenance contract.

**WARNING:** The ability to properly perform maintenance on this equipment requires certain expertise, mechanical skills, tools and equipment. If you do not possess these, do not attempt to perform any maintenance on this equipment other than those procedures recommended in the Owner's Manual. **A FAILURE TO HEED THIS WARNING COULD RESULT IN SERIOUS PERSONAL INJURY AND EQUIPMENT DAMAGE.**

The minimum maintenance requirements for this equipment are as follows:

1. Inspect air filter(s) each month. Clean or replace when necessary.
2. Inspect cooling coil, drain pan, and condensate drain each cooling season for cleanliness. Clean when necessary.
3. Inspect blower motor and wheel for cleanliness and check lubrication each heating and cooling season. Service when necessary.
4. Check electrical connections for tightness and controls for proper operation each heating and cooling season. Service when necessary.
5. Check and inspect heating section before each heating season. Clean and adjust when necessary.

**WARNING:** A failure to follow these warnings could result in serious personal injury:

1. Turn off gas supply, then disconnect electrical power to unit before performing any maintenance or service.
2. Use extreme caution when removing panels and parts. As with any mechanical equipment, personal injury can result from sharp edges, etc.
3. Never place anything combustible either on, or in contact with unit.
4. Should overheating occur, or gas supply fail to shut off, first shut off external main manual gas valve to unit, then shut off electrical supply.



## Top Removal

**WARNING:** When removing unit top, use extreme caution to protect seal that isolates heat exchanger and flue products from other sections. Removal of top must never be attempted by anyone other than qualified technicians.

**CAUTION:** Condenser fan and motor are fastened to unit top. When removing top, use extreme care to not pull fan motor leads loose.

**NOTE:** When performing maintenance or service procedures that require removal of unit top, be sure to perform *all* routine maintenance procedures that require top removal, including: inspection of heat exchanger area, coil inspection and cleaning, and condensate drain pan inspection and cleaning.

When performing maintenance and service procedures that require unit top removal, refer to following top removal procedures:

1. Turn off gas supply, *then* disconnect electric power to unit.
2. Remove vent cap and combustion-air assemblies. Do not damage gasket. Refer to Venting section and reverse assembly procedures shown.
3. Remove all screws that secure unit top, including screws around 4 sides and those on top that screw into internal divider panels. Save all screws.
4. Tape all side panels at each seam near unit top. Use tape strips that are at least 5 in. long to prevent sides from falling when top is removed.
5. Carefully lift top from unit. Set top on edge and ensure that it is supported by unit side that is opposite duct (or plenum) side. *Use extreme care to prevent damage to the seal that isolates heat exchanger and flue products, or the fan blades, motor and insulation.*

**WARNING:** If seal that isolates heat exchanger and flue products is damaged, repair seal using same type of foil-back insulation used at time of manufacture, and/or aluminum duct tape, depending on severity of damage. **FAILURE TO HEED THIS WARNING COULD RESULT IN SERIOUS PERSONAL INJURY TO OCCUPANTS OF THE CONDITIONED SPACE.**

6. Carefully replace and secure unit top to unit, using screws removed in step 3 when maintenance and/or service procedures are concluded. Be sure to use original screws that have rubber washers to seal out water when securing top to internal divider panels.
7. Reinstall vent cap and combustion-air assemblies. Refer to Venting section.

## Air Filter

**CAUTION:** Never operate unit without a suitable air filter in return-air duct system. Always replace filter with same size and type. See Table 2 for filter sizes.

Inspect field-supplied air filter(s) at least once each month and replace (disposable type) or clean (cleanable type) at least twice during each heating and cooling season or whenever the filter(s) becomes clogged with dust and lint.

**Evaporator Blower Wheel and Motor** — For longer life, operating economy and continuing efficiency, clean accumulated dirt and grease from blower wheel and motor annually.

Lubricate motor every 5 years if motor is used intermittently (thermostat FAN switch in AUTO. position), or every 2 years if motor is used continuously (thermostat FAN switch in ON position).

**WARNING:** Turn off gas supply, *then* disconnect and tag electrical power to unit before cleaning and lubricating blower motor and wheel.

Clean and lubricate blower motor and wheel as follows:

1. Remove and disassemble blower assembly.
  - a. Remove blower and control access panels.
  - b. Refer to unit wiring label and disconnect blower motor leads from their termination points in unit control box. Be sure to mark wiring label appropriately if lead terminations were not previously marked. Pull leads into blower compartment.
  - c. Remove blower assembly from unit. Be careful not to tear insulation in blower compartment.
  - d. Ensure proper reassembly by marking blower wheel and motor in relation to blower housing before disassembly.
  - e. Loosen setscrew(s) that secures wheel to motor shaft, remove screws that secure motor mount brackets to housing, and slide motor and motor mount out of housing.
2. Lubricate motor.
  - a. Thoroughly clean all accumulations of dirt or grease from motor housing.
  - b. Remove dust caps or plugs from oil ports located at each end of motor.
  - c. Use a good grade of SAE 20 nondetergent motor oil and put one teaspoon, 5 cc, 3/16 oz., or 16 to 25 drops in each oil port.
  - d. Allow time for oil to be absorbed by each bearing, then wipe excess oil from motor housing.
  - e. Replace dust caps or plugs in oil ports.

3. Remove and clean blower wheel.
  - a. Ensure proper reassembly by marking wheel orientation and cutoff plate location.
  - b. Remove screws holding cutoff plate, and remove plate from housing.
  - c. Lift wheel from housing. When handling and/or cleaning blower wheel, be sure not to disturb balance weights (clips) on blower wheel vanes.
  - d. Remove caked-on dirt from wheel and housing with a brush. Remove lint and/or dirt accumulation from wheel and housing with vacuum cleaner, using soft brush attachment. Remove grease and oil with mild solvent.
  - e. Reassemble wheel and cutoff plate into housing.
  - f. Reassemble motor into housing. Be sure set-screws are tightened on motor shaft flats and not on round part of shaft.
4. Reinstall blower assembly into unit. Route blower motor leads into control compartment and reconnect all blower motor leads to proper termination points in unit control box. Replace panels.
5. Restore electrical power, *then* gas supply, to unit. Start unit and check for proper blower rotation and motor speeds during heating and cooling cycles.

**Heating Section** — Ensure dependable and efficient heating operation by inspecting heating section before each heating season and cleaning when necessary. Proceed as follows:

1. Turn off gas supply, *then* disconnect electrical power to unit.
2. Inspect and clean heating section.
  - a. Remove control access door.
  - b. Remove unit top following procedures under Top Removal.
  - c. Remove secondary-air shield, flue baffles, pilot and burners. Flue baffles may be removed after partial loosening of collector front panel. Inspect and clean all of these components. Be sure to remove any residue that may have collected on a component.
  - d. Clean flue ways with brush and/or vacuum, and inspect heat exchanger for leaks and cracks.
  - e. Inspect indoor-air passages in unit for cleanliness and check tightness of screws and parts.
  - f. Replace all components removed in step c, and replace unit top.
3. Restore electrical power, *then* gas supply to unit. Start heating cycle and adjust burner air shutters. See Heating Section Start-up and Adjustments — Adjusting Burner Air Shutters.

**WARNING:** Never use a match or other flame to check for gas leaks.

4. Inspect gas control area for gas leaks, using a soap-and-water solution.
5. Replace control access panel.

**Pilot** — Inspect the pilot and clean (when necessary) at beginning of each heating season. Remove accumulation of soot and carbon from only the outside of the pilot. The pilot flame must be high enough to properly touch flame-sensing element and to light burners.

**Condenser Coil, Evaporator Coil and Condenser Drain Pan** — Inspect condenser coil, evaporator coil and condensate drain pan at least once each year. Proper inspection and cleaning requires removal of unit top. See Top Removal section.

Coils are easily cleaned when dry; therefore, inspect and clean coils either before or after each cooling season. Remove all obstructions including weeds and shrubs that interfere with airflow thru condenser coil. Straighten bent fins with a fin comb. If coated with dirt or lint, clean coils with a vacuum cleaner, using soft brush attachment. Be careful not to bend fins. If coated with oil or grease, clean coils with mild detergent and water solution. Rinse coils with clear water, using a garden hose. Be careful not to splash water on motors, insulation, wiring or air filter(s). For best results, spray condenser coil fins from inside to outside of unit. On units with an outer and inner condenser coil, be sure to clean between coils. Be sure to flush all dirt and debris from unit base.

Inspect drain pan and condensate drain line when inspecting the coils. Clean drain pan and condensate drain by removing all foreign matter from pan. Flush pan and drain tube with clear water. Do not splash water on insulation, motor, wiring or air filter(s). If drain tube is restricted, clear it with a plumber's snake or similar probe device.

The bottom of drain tube has a 1/8-in. diameter hole. This hole is located in the portion of the drain tube that runs thru drain pan. Clean this hole with a stiff wire that has a 3/8-in. long, 90 degree bend.

### Condenser Fan

**CAUTION:** Keep condenser fan free of all obstructions to ensure proper cooling operation. Never place articles on top of unit.

Inspect fan blades for cracks or bends each year. *Ensure that blades clear the motor by exactly 1/4 inch.* If blade assembly has slipped down motor shaft, adjust fan position on motor shaft by loosening setscrew(s), then moving blade assembly up. Be sure setscrew(s) is on flat(s) of shaft before tightening.

**Electrical Controls and Wiring** — Inspect and check electrical controls and wiring annually. *Be sure to turn off gas supply and then electrical power to unit.*

Remove control, blower and compressor compartment access panels to locate all electrical controls and wiring. Check all electrical connections for tightness. Tighten all screw connections. If any smoky or burned connections are noticed: disassemble the connection, clean all parts, restrip wire end and reassemble connection properly and securely.

After inspecting electrical controls and wiring, replace all panels. Start unit and observe at least one complete heating cycle and one complete cooling cycle to ensure proper operation. If discrepancies are observed in either or both operating cycles, or if a suspected malfunction has occurred, check each electrical component with proper electrical instrumentation. Refer to unit wiring label when making these checkouts.

NOTE: Refer to heating and/or cooling sequence of operation in this publication as an aid in determining proper control operation.

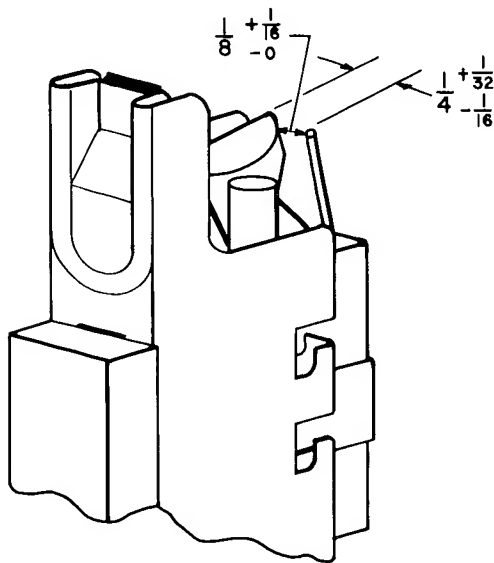


Fig. 11 — Position of Electrode to Pilot

**Refrigerant Circuit** — Annually inspect all refrigerant tubing connections and unit base for oil accumulations. Presence of oil generally indicates a refrigerant leak.

If oil is detected or if low-cooling performance is suspected, leak-test all refrigerant tubing using an electronic leak detector, halide torch, or liquid-soap solution. If a refrigerant leak is detected, see Unit Preparation — Refrigerant Leaks.

If no refrigerant leaks are found and low-cooling performance is suspected, see Cooling Section Start-up and Adjustments — Checking and Adjusting Refrigerant Charge section.

**Gas Input** — Gas input does not require checking unless improper heating performance is suspected. If a problem exists, refer to Heating Section Start-up and Adjustments section.

**Evaporator Airflow** — Heating and/or cooling airflow does not require checking unless improper performance is suspected. If a problem exists, be sure all supply- and return-air grilles are open and free from obstructions, and air filter is clean. When necessary, refer to Cooling Section Start-up and Adjustments Indoor Airflow and Airflow Adjustments section to check system airflow.

**TROUBLESHOOTING CHART**  
**Table 8 — Heating Service Analysis Chart**

SYMPTOM	PROBABLE CAUSE	REMEDY
Pilot will not light	No spark at electrode	Check air gap between electrode tip and pilot burner. Gap should be as shown in Fig 11 Readjust as necessary Clean moisture or dirt accumulation on electrode ceramic with cloth. Cracked ceramic — replace pilot electrode assembly Check for loose or broken wiring at and between spark generator and electrode. Replace wire or tighten connection as necessary. Check fuses or circuit breaker to ensure voltage to unit Check 24-volt input to spark generator. If you read 24 volts, and above steps have been completed, replace spark generator
	Spark shorting out to main burner	Realign electrode tip away from main burner but maintain spark gap to pilot burner See Fig 11
	No gas at pilot burner	Clean pilot orifice. Check for voltage to terminals no. 3 and 5 of gas valve. Check to see if pilot valve is opening Check for loose or broken wiring connections If no deficiency is found, replace gas valve
Burners will not ignite	Water in gas line	Drain — install water trap
	No power to furnace	Check power supply, fuses, wiring, or circuit breaker
	No 24-volt power supply to control circuit	Check transformer — replace if necessary.
	Miswired or loose connections	Check all wiring and wirenut connections
	Dirty pilot — yellow flame	Clean pilot orifice
	Pilot burning improperly — sharp blue flame	Replace pilot
	Burned-out heat anticipator in thermostat	Replace thermostat.
	No gas at main burners	Check to see if main gas valve is opening Look for loose or broken wiring connections If no deficiency is found, replace valve assembly
	Broken thermostat wire	Run continuity check to locate break
Inadequate heating	Dirty air filter	Clean or replace filter as necessary
	Gas input to furnace too low	Check gas pressure at manifold Clock gas meter for input If too low, increase manifold pressure, or replace with correct orifices
	Unit undersized for application	Replace with proper unit — or add additional unit
	Restricted airflow	Clean or replace filter — or remove any restriction
	Blower speed too low	Use faster speed tap — or install optional blower.
	Limit switch cycles main burners	Dirty air filters — clean or replace Registers closed, restricted ductwork — open or remove restriction Check heat anticipator setting on thermostat — readjust
Poor flame characteristics	Incomplete combustion results in: Aldehyde odors, (CO), sooting flame — floating flame	Air shutters on burners closed — adjust to soft blue flame Check all screws around flue outlets and burner compartment — tighten Lack of Combustion air See Installation section Cracked heat exchanger — replace. Overfired furnace — reduce input, or change orifices Check vent for restriction — clean as required Check orifice to burner alignment.

**TROUBLESHOOTING CHART**  
**Table 9 — Cooling Service Analysis Chart**

SYMPTOM	PROBABLE CAUSE	REMEDY
<b>Compressor and condenser fan will not start</b>	Power failure	Call power company
	Fuse blown or circuit breaker tripped	Replace fuse or reset circuit breaker.
	Defective thermostat, contactor, transformer, or control relay	Replace component
	Insufficient line voltage	Determine cause and correct
	Incorrect or faulty wiring	Check wiring diagram and rewire correctly
	Thermostat setting too high	Lower thermostat setting below room temperature
<b>Compressor will not start but condenser fan runs</b>	Faulty wiring or loose connections in compressor circuit	Check wiring and repair or replace
	Compressor motor burned out, seized, or internal overload open	Determine cause Replace compressor.
	Defective run/start capacitor, overload, start relay	Determine cause and replace
	One leg of 3-phase power dead	Determine cause Replace fuse or reset circuit breaker
<b>Compressor cycles (other than normally satisfying thermostat)</b>	Refrigerant overcharge or undercharge	Blow refrigerant, evacuate system, and recharge to nameplate
	Defective compressor	Determine cause, replace
	Insufficient line voltage	Determine cause and correct
	Blocked condenser	Determine cause and correct
	Defective run/start capacitor, overload, or start relay	Determine cause and replace
	Defective thermostat	Replace thermostat
	Faulty condenser fan motor or capacitor	Replace
<b>Compressor operates continuously</b>	Restriction in refrigerant system	Locate restriction and remove
	Dirty air filter	Replace filter
	Unit undersized for load	Decrease load or increase unit size
	Thermostat set too low	Reset thermostat.
	Low refrigerant charge	Locate leak, repair, and recharge
	Leaking valves in compressor	Replace compressor
	Air in system	Blow refrigerant, evacuate system, and recharge
<b>Excessive head pressure</b>	Condenser coil dirty or restricted	Clean coil or remove restriction
	Dirty air filter	Replace filter
	Dirty condenser coil	Clean coil
	Refrigerant overcharged	Purge excess refrigerant.
	Air in system	Blow refrigerant, evacuate system, and recharge
	Condenser air restricted or air short-cycling	Determine cause and correct
<b>Head pressure too low</b>	Low refrigerant charge	Check for leaks, repair, and recharge
	Compressor valves leaking	Replace compressor.
	Restriction in liquid tube	Remove restriction
<b>Excessive suction pressure</b>	High heat load	Check for source and eliminate
	Compressor valves leaking	Replace compressor
	Refrigerant overcharged	Purge excess refrigerant.
<b>Suction pressure too low</b>	Dirty air filter	Replace filter
	Low refrigerant charge	Check for leaks, repair, and recharge
	Metering device or low side restricted	Remove source of restriction.
	Insufficient evaporator airflow	Increase air quantity Check filter — replace if necessary
	Temperature too low in conditioned area	Reset thermostat
	Outdoor ambient below 55 F	Install accessory low-ambient kit
	Field-installed filter drier restricted	Replace.



For replacement items use Carrier Specified Parts

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Book	1	4
Tab	1a	1a

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Catalog No 534-843